

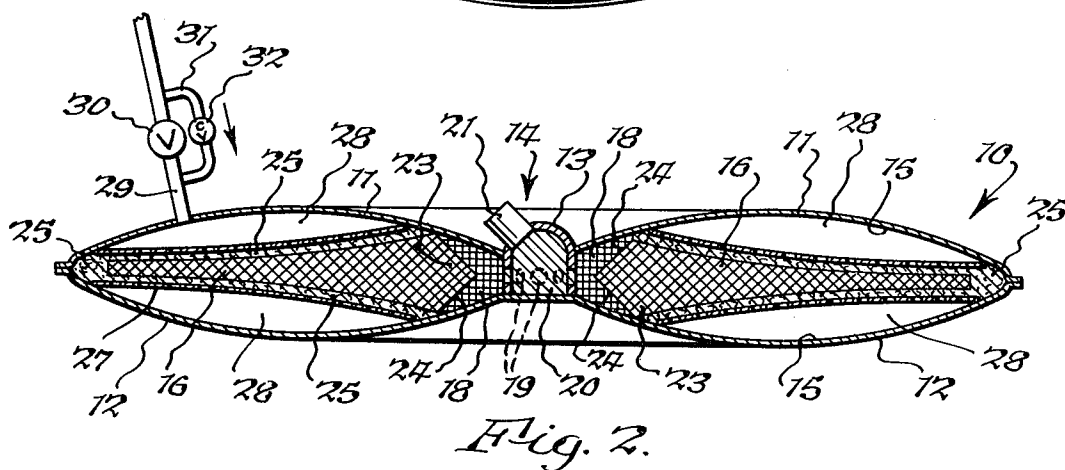
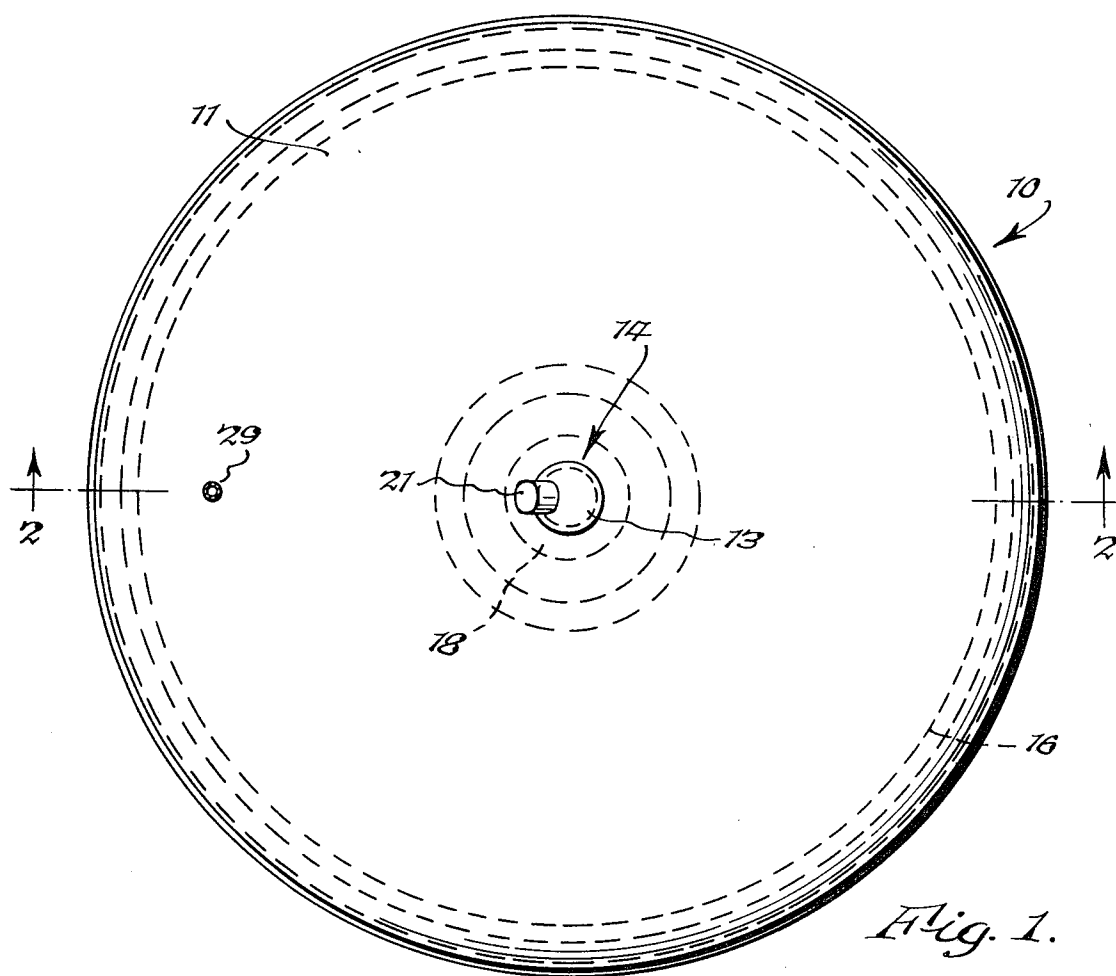
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CHEMICAL OXYGEN GENERATOR

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CHEMICAL OXYGEN GENERATOR

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11 Claims

ABSTRACT OF THE DISCLOSURE

Solid state combustible oxygen generating material for a chemical oxygen generator is disposed in a toroidal housing having an annular chamber with an ignition area about its inner periphery, the generating material being formed in a ring having radially outwardly converging side faces to provide a peripheral generating face of substantially constant area as the generating material burns radially outwardly whereby a substantially constant oxygen generating rate is maintained for the life of the generator. The housing and ring of generating material define a reservoir therebetween which serves to collect the generated oxygen.

BACKGROUND OF THE INVENTION

This invention relates to a breathing fluid generator and particularly to a chemical solid state breathing fluid generator having a relatively flat, disk-like configuration providing a sustained and substantially constant breathing fluid generating rate for the life of the generator.

Solid state chemical breathing fluid generators, sometimes referred to as candles, are known and are highly desirable for use in auxiliary breathing fluid supply systems. However, in certain applications, particularly in aircraft, available space in which to dispose such oxygen candles is minimal and often not of a configuration particularly well adapted to accommodate candles of conventional cylindrical configuration. For example, the lid of a rigid seat aircraft survival kit is a desirable location for a chemical oxygen generator, because it goes with the pilot upon ejection. However, such lids are on the order of fifteen by seventeen inches in lateral dimensions and only two inches in depth. The provision of a chemical oxygen generator capable of a substantial oxygen flow at a substantially constant, adequate rate and also capable of fitting within such a confined space presents problems solved by this invention.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a compact, one-piece solid-state breathing fluid generator adapted to generate breathing fluid at a substantially constant rate and configured to occupy a shallow space such as a lid of a rigid seat survival kit.

It is another object of the present invention to provide a breathing fluid generator having the foregoing characteristics and configured in the general form of a disk.

It is still another object of the present invention to provide a breathing fluid generator having the foregoing characteristics which is easily fabricated and which provides a reservoir concentric with the disk-shaped generating material for collecting the generated breathing fluid.

In one aspect thereof the breathing fluid generator of the present invention is characterized by the provision of combustible breathing fluid generating material in the form of an annulus, an ignition area formed about and contiguous with a periphery of the annulus, and means for igniting the ignition area to thereby substantially simultaneously ignite the material about the periphery of the annulus and thereby provide a peripheral breathing

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fluid generating face burning in a radial direction, the annulus being formed so that its peripheral generating face remains substantially constant in area as it burns in the radial direction whereby breathing fluid is generated at a substantially constant rate.

The foregoing and other objects, advantages and characterizing features of the breathing fluid generator construction of the present invention are pointed out in the following detailed description of a typical embodiment thereof considered in conjunction with the accompanying drawing depicting the same wherein like numerals represent like parts throughout the various views.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of one form of breathing fluid generator constructed in accordance with the present invention; and

FIG. 2 is a cross sectional view thereof taken about on line 2—2 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, there is shown a breathing fluid generator constructed in accordance with the present invention comprising a metal or ceramic container generally designated 10. Container 10 is formed by a pair of annular, oppositely disposed, convex side plates 11 and 12 having outer peripheral flanges welded or otherwise secured together. The inner peripheral edges of plates 11 and 12 are axially spaced apart and welded to or otherwise secured about the casing 13 of a centrally disposed ignitor generally designated 14. Container 10 thus forms a torus defining an annular chamber 15 which is substantially elliptical in cross section, as seen in FIG. 2.

An oxygen generating composition generally designated 16, is disposed within chamber 15 and preferably comprises a cast or compacted candle composed of a chlorate or perchlorate which evolves oxygen upon combustion, a metal powder such as iron or carbon for burning and supplying part of the heat required to sustain combustion, a binder such as an inorganic glass fiber for holding the mass together and aiding in the even decomposition of the chlorate or perchlorate, and a peroxide for chemically eliminating the traces of chlorine gas released during thermal breakdown of the chlorate or perchlorate to the chloride. The composition may be press molded or cast to form a ring concentric within annular chamber 15, the ring 16 having its inner periphery spaced radially outwardly from ignitor 14. An annular ignition area 18 is provided between the inner periphery of ring 16 and casing 13 and extends between face plates 11 and 12 adjacent their inner peripheries. Ignition area 18 comprises the foregoing cast or compacted oxygen generating composition enriched with a metal powder, such as iron, to provide a concentrated annular area of intense heat when ignited.

Ignitor 14 comprises a cup-shaped capsule 13 having a plurality of circumferentially spaced orifices 19 opening radially through its sides about the inner periphery of ignition area 18 medially between the inner peripheries of face plates 11 and 12. Capsule 13 is packed with a flash or fusee type material 20 which can be detonated by any conventional type of ignitor cap 21, such as a phosphorus match, electrical squib or the like, and can be closed at its lower end if desired or necessary. With the foregoing arrangement, detonation of the flash or fusee material distributes heat equally about capsule 13 through orifices 19 to ignite the metal powder enriched composition in ignition area 18 whereby the latter composition burns radially outwardly at an approximately equal rate about the generator axis to substantially simultaneously ignite the entire inner periphery of the ring of oxygen generating material 16.

The composition of candle 16, ignition area 18 and flash material 20, and the construction of ignitor 21 can be conventional and are per se no part of this invention.

It is a significant feature of this invention that oxygen is generated at a sustained substantially constant rate from oxygen generating body 16 as it burns radially outwardly about its periphery. Since the oxygen generating rate is directly proportional to the burning area, ring 16, comprising the oxygen generating composition, is formed to provide a circumferential generating face concentric with the axis of torus 10 of substantially constant area for all radial burning positions. To this end, ring 16 is formed so that its widest axial dimension lies adjacent its inner periphery as indicated at 23 with the side faces thereof being formed to arcuately converge toward one another in an expanding radial direction thereby providing ring 16 with concave side faces and an outer peripheral edge substantially reduced in width. Thus the thickness of ring 16 is progressively reduced in a radially outward direction to compensate for the progressively increasing circumference of the generating face, whereby the area of the latter is maintained substantially constant for all radial positions thereof.

In order to generate a sufficient quantity of oxygen, on the order of 20 liters per minute, a burning cross sectional area of approximately 10 square inches of the foregoing generating composition is required. Thus, if the widest axial dimension 23 of ring 16 is disposed one inch from the center of the generator, the maximum axial width of ring 16 at 23 would be on the order one and one-half inches. With the diameter of the generator on the order of 13 inches, fluid will be supplied at this rate for about 15 minutes. Thus, it is seen that a relatively thin ring of oxygen generating composition can adequately meet the oxygen requirements of a pilot or other user in an emergency, the foregoing dimensions being illustrative only and in no way limiting the present invention.

As seen in FIG. 2, the inner peripheral portion of ring 16 projects radially inwardly from its widest point 23, the illustrated embodiment showing inwardly converging annular inclined edges 24. In this manner, a large initial area of oxygen generating composition is formed about the outer periphery of ignition section 18 and is thus exposed to the intense heat generated in ignition section 18 for rapid and complete ignition of the entire peripheral generating face of composition 16 at its widest axial dimension 23. This inward projection is not intended to be limited to inclined annular edges and could be an annular arcuate or bulbous projection or otherwise shaped.

A filter of heat insulating material 25, such as fibreglass, lines the side faces and extends about the outer periphery of ring 16 to filter, from the generated oxygen, particles of chloride that would otherwise appear as chloride smoke in the usable oxygen. In the illustrated form, a pair of arcuate, annular metal shields 27 are suitably secured to the interior surfaces of face plates 11 and 12 adjacent their inner and outer peripheries as by welding or the like to clamp ring 16 and filter material 25 in place within annular chamber 15. Shields 27 are perforated to permit the generated oxygen to pass outwardly therethrough and collect in the annular chambers or reservoirs 28 defined between the respective shields and their associated side plates 11 and 12, the chambers 28 being in open communication with one another through filter 25 disposed between the outer periphery of ring 16 and torus 10. Other semi-rigid, permeable materials, such as screening, could also be used in place of perforated sheet 27 or the fibreglass 25 can be impregnated with a silicate or other hardening agent sufficient to make the same shape-sustaining in the form shown.

An oxygen outlet conduit 29 is provided through side face 11 of torus 10 for communicating between reservoir

28 and a user. A normally closed valve 30 and a bypass conduit 31 having a check valve 32 are illustrated whereby the reservoir chambers 28 can be connected to another oxygen source, such as the ship supply, to maintain reservoirs 28 filled with oxygen under pressure prior to use. Upon opening valve 30 simultaneously with actuation of ignitor 21, reservoirs 28 will supply oxygen initially while oxygen generator 16 builds to an adequate and sustained oxygen generating rate.

The operation of the oxygen generator is believed to be obvious from the foregoing description. Ignitor cap 21 is actuated by any suitable means, not shown, either manually or automatically, to ignite the flash or fusee material 20 in ignitor 14. The heat therefrom is propagated radially through orifices 19 to ignite the enriched composition in ignition area 18. The intense heat thus generated ignites oxygen generating composition 16 at annular inclined edges 24 whereby oxygen is generated from a generating face of substantially constant area as ring 16 burns in an outward radial direction from its widest axial dimension 23 to its narrowest axial dimension at the outer periphery thereof. The liberated oxygen passes axially outwardly through filter 25 and perforated shields 27 to accumulate in reservoirs 28 for communication to a user thereof via conduit 29. An adequate, sustained and substantially constant oxygen generating rate is thus provided for the burning life of ring 16.

Having thus described and illustrated the preferred form of our invention, it will be understood that such description and illustrated is by way of example only and that such modifications and changes as may suggest themselves to those skilled in the art are intended to fall within the scope of the present invention which is limited only by the appended claims.

What we claim as new is:

1. A breathing fluid generator comprising a ring-shaped body of combustible material capable of evolving oxygen formed to provide an annulus extending about a central axis, said annulus having a lateral dimension greater than its central axial dimension, an ignition section formed about said axis and contiguous with a lateral periphery of said annulus, and means for igniting said ignition section to thereby substantially simultaneously ignite said material about said periphery and provide a peripheral oxygen generating face burning in a radial direction, said annulus being formed so that the area of said peripheral generating face remains substantially constant as said material burns in said radial direction whereby fluid is generated at a substantially constant rate.

2. A breathing fluid generator according to claim 1 wherein said annulus has radially outwardly converging opposite side faces whereby said annulus is thicker adjacent its inner periphery than at its outer periphery.

3. A breathing fluid generator according to claim 2 wherein said ignition section is annular in shape and lies about the inner periphery of said annulus, said igniting means including a centrally disposed capsule and having a plurality of orifices opening radially into the inner periphery of said annular ignition area, ignition material disposed in said capsule, and means to ignite said ignition material whereby the heat generated by said ignition material propagates radially through said orifices to ignite said ignition section, said ignition section being arranged to ignite the inner periphery of said annulus substantially simultaneously.

4. A breathing fluid generator according to claim 2 wherein said ignition section lies about the inner periphery of said annulus and the inner periphery of said annulus projects inwardly beyond the thickest portion thereof into said ignition section to present a larger peripheral area to said ignition section than the peripheral area of said annulus at the thickest portion thereof.

5. A breathing fluid generator according to claim 1 wherein said annulus has opposite side faces arcuately

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converging toward one another to form oppositely disposed annular concavities.

6. A breathing fluid generator according to claim 1 including a housing, means securing said annulus within said housing, said annulus and said housing being formed to provide a space therebetween to serve as a reservoir for collecting the generated breathing fluid.

7. A breathing fluid generator according to claim 6 wherein said housing is a torus having convex side portions, said annulus having opposite side faces arcuately and concavely converging toward one another to form, with said side portions, a pair of oppositely disposed annular reservoirs for collecting the generated breathing fluid.

8. A breathing fluid generator according to claim 7 wherein said reservoirs are in open communication with one another.

9. A breathing fluid generator according to claim 7 including a permeable liner formed about the side faces of said annulus and secured to said torus, said liner clamping said annulus to said torus in spaced relation thereto.

10. A breathing fluid generator according to claim 7, together with a layer of heat insulating filter material on said opposite side faces of said annulus.

11. A breathing fluid generator comprising combustible material capable of evolving oxygen formed to provide an annulus, an ignition area formed about and contiguous with a periphery of said annulus, and means for igniting said ignition area to thereby substantially simultaneously ignite said material about said periphery and provide a peripheral oxygen generating face burning in a radial direction, said annulus being formed so that the area of said peripheral generating face remains substantially constant as said material burns in said radial direc-

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tion whereby fluid is generated at a substantially constant rate, said annulus having radially outwardly converging opposite faces whereby said annulus is thicker adjacent its inner periphery than at its outer periphery, said ignition area being annular in shape and lying about the inner periphery of said annulus, said igniting means including a centrally disposed capsule having a plurality of orifices opening radially into the inner periphery of said annular ignition area, ignition material disposed in said capsule, and means to ignite said ignition material whereby the heat generated by said ignition material propagates radially through said orifices to ignite said ignition area, said ignition area being arranged to ignite the inner periphery of said annulus substantially simultaneously, a housing, means securing said annulus within said housing, said annulus and said housing being formed to provide a space therebetween to serve as a reservoir for collecting the generated breathing fluid, said housing being a torus having convex side portions, said annulus having opposite side faces arcuately and concavely converging toward one another to form with said side portions, a pair of oppositely disposed annular reservoirs for collecting the generated breathing fluid.

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